The Impact of Menu Variety on Consumer Decision-Making: A Starbucks Experiment

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I. Introduction

In today's consumer landscape, choice is often seen as a sign of abundance and personalization. However, having too many or too few options can sometimes hinder decision-making, a phenomenon known as choice overload. When faced with too many choices, individuals may experience decision fatigue, leading to increased difficulty in making selections, lower satisfaction, and potentially suboptimal decisions. For example, recent research found that about one in three Americans feels overwhelmed by restaurant menus, a feeling informally dubbed "menu anxiety."[1] This effect is particularly pronounced among Gen Z and Millennials, who are more prone to experiencing decision paralysis when faced with an overwhelming number of menu choices. To explore this phenomenon further, we chose Starbucks as the setting for our experiment. Starbucks is known for its extensive drink menu, which makes it an ideal environment to examine choice overload in a realistic scenario. With its structured menu categories and broad customer base, Starbucks provides us with a perfect testing ground to understand how menu quantity affects decision quality.

II. Experimental Design

This study aims to examine whether the number of beverage options on a Starbucks menu influences consumer decision-making. Using an A/B test framework, participants are randomly assigned to one of two conditions: a limited menu with only a few beverage options or an extensive menu that offers a wide range of drinks. By analyzing participants' choices, we seek to determine whether an increased variety leads to cognitive overload, affects default selection patterns, and alters decision confidence. The findings will provide insights into how menu design influences customer behavior and determine whether reducing complexity can enhance customers ' overall decision-making experience.

❖ Unit of Randomization

In this experiment, the unit of randomization is the individual participant. Since our study primarily focuses on Gen Z and Millennials, with the majority being students, this randomization approach allows us to explore how younger consumers navigate choice complexity. By analyzing their selections, we can assess whether the number of menu options influences decision confidence, selection patterns, and default choices.

To ensure the fairness of the experiment, we will use a **completely randomized design** to assign participants to one of two experimental conditions: a small menu group (providing

[1] Liz Neporent | July 31, 2023. "Why 30% of Americans Experience 'Menu Anxiety.'" Psychiatrist.com, August 2, 2023. https://www.psychiatrist.com/news/why-30-of-americans-experience-menu-anxiety/#:~:text=The%20struggle%20is%20real%20for,%E2%80%9D.

only a few selected beverage options) or a large menu group (providing a wider range of beverage choices). This randomization process can eliminate selection bias, which ensures that the observed differences in decision behavior in experiments are only caused by differences in menu size rather than individual preferences or external factors. Through this design, we can effectively analyze whether the number of menu options will have an impact on consumers' choice patterns, decision-making confidence, and the selection of default options.

❖ Experimental Group Design

We observe consumer choice behavior by setting two different menus but with the same proportion of product categories (total 4 categories: Coffee-Based, Tea-Based, Frappuccino®, Refresher; each category accounts for 25%) in the environment and analyze the impact of different menu complexities on decision consistency. The experiment used random assignment to divide the subjects into the following two groups:

1. **Treatment Group**

- The subjects were randomly assigned to a Limited Menu Group, where they could only select beverages from a simplified menu (contains 8 beverages).
- The goal is to simulate a choice-constrained environment to observe whether reducing menu options will lead consumers to be more inclined to choose their default beverage.
- We use ‘Treat = True’ to mark this group of subjects.

2. **Control Group**

- The subjects were randomly assigned to an Extensive Menu Group, where they could select beverages from a complete menu (contains 32 beverages).
- This group represents an environment of freedom of choice to observe whether a rich menu of options will encourage consumers to explore new choices or still maintain their original decision-making habits.
- We use ‘Treat=False’ to mark this group of subjects.

❖ Define Hypothesis

In our experiment, we focus on whether menu complexity affects consumer decision-making behavior, so we formulate the following null hypothesis (H_0) and alternative hypothesis (H_1):

- H_0 (null hypothesis): Menu complexity does not affect choice consistency; there is no significant difference in choice consistency between the test group (Treat=True) and the control group (Treat=False).
- H_1 (alternative hypothesis): Menu complexity affects choice consistency; there is a significant difference in choice consistency between the test group (Treat=True) and the control group (Treat=False).

❖ Outcome Measurement

In this experiment, we mainly investigate whether the complexity of menus affects consumers' choice behavior. To quantify this impact, we define the following Outcome Measurement metrics:

Choice Consistency (Primary Metric)

- Calculate whether the final selected beverage category is consistent with the subject's default category options.
- This indicator is used to evaluate whether the complexity of the menu affects whether consumers are more inclined to choose familiar drinks or more willing to try new options.

Decision Time Range (Secondary Metrics)

- Record the time required for subjects to make choices during the experiment.
- This indicator helps analyze whether menu complexity affects decision efficiency (e.g., whether extensive menus lead to longer decision times).

❖ Data Collection

To simulate the ordering environment of Starbucks more realistically, we provided pictures of Starbucks beverages in the survey to help participants make more intuitive choices. The subjects were randomly assigned to one of two menu types. In order to ensure the fairness of the experiment, the proportion of different categories of drinks in the two menus should be consistent to avoid the influence of different proportions of certain drinks on the subjects' choices. The survey covers multiple aspects to comprehensively understand consumers' decision-making habits, including Personal characteristics: age, occupation, Starbucks consumption frequency, menu familiarity, etc.

❖ Data Preprocessing and Cleaning

During the data processing, we standardized and classified the participants' beverage choices, default options, and uncertain choices. Specifically, we categorized beverages into Tea-based beverage, Coffee-based beverage, and Frappuccino® or Refresher beverage. In addition, we classified the subjects' default choice equally to ensure data consistency. After we collect data, we need to add a new variable (changed_preference) to quantify whether the subject has changed his or her choice. For example, subject A chooses a coffee-based drink as his or her preference at the beginning of the survey. After a few questions (such as age, occupation, etc.), we will release our menu. The purpose of this is to make the subject forget his or her initial choice to a certain extent and browse the menu we provide to make a new choice. If the subject chooses Pink Drink, which is Refresher, then this is contrary to the initial preference. We will fill in 1 in the changed_preference column of this row of data (or 0 otherwise), which means that our menu has changed his or her choice. Through these steps, we ensure that the data is clearer, easier to compare, and can be used to further analyze the impact of menu complexity on consumer decision-making behavior.

Feature Name	Description
age	Age group of the participant
occupation	Participant's occupation
visit_frequency	Frequency of Starbucks visits
menu_familiarity	Self-reported familiarity with the Starbucks menu
selected_beverage	The specific drink chosen by the participant
selected_beverage_category	The category of the chosen drink (e.g., Coffee, Tea)
default_choice	Participant's typical or preferred beverage category
decision_duration	Categorized duration of decision-making
treat	Experimental condition (1 = Limited Menu, 0 = Extensive Menu)
choice_consistency	Whether the chosen beverage matches the default choice
changed_preference	Whether the chosen beverage differs from the default choice

Table 1: Feature Description

❖ Exploratory Data Analysis

To better understand the structure of our dataset and the distribution of key variables, we conducted an Exploratory Data Analysis (EDA) before performing statistical tests. This process allowed us to examine the balance between the treatment and control groups, as well as the distribution of choice-related behaviors among participants.

Treatment Distribution: The dataset comprises 51.9% individuals in the Limited Menu group (treatment) and 48.1% in the Extensive Menu group (control).

Selected Beverage Distribution: The most commonly selected beverage categories include Coffee-based beverage (38.9%), Frappuccino® (27.8%), Tea-based beverage (18.5%), and Refresher beverage (14.8%).

Default Choice Distribution: Participants' default choices were distributed as follows: Coffee-based beverage (52.9%), Frappuccino® (22.1%), Tea-based beverage (13.5%), and Refresher beverage (11.5%).

Choice Consistency Distribution: 49.1% of participants selected a beverage that matched their default choice, while 50.9% chose a drink that differed from their default choice.

Changed Preference Distribution: 50.9% of participants changed their beverage preference, while 49.1% remained consistent with their default choice.

❖ Randomization Checks

To ensure the validity of our experiment, we performed an independent randomization check on our data distribution using the chi-square test and used it to assess whether key

demographic variables (age, occupation, frequency of Starbucks visits, and menu familiarity) were evenly distributed between the experimental group (limited menu) and the control group (extensive menu). The results showed that the p-values for all variables were over 0.05, meaning that the two groups did not differ significantly on these characteristics. This confirmed that the randomization process was effective and ensured that any differences in consumers' decision-making behavior could be attributed to menu complexity rather than pre-existing biases.

Chi-square Test Results:

	Chi-square Statistic	p-value
Age	2.021291	0.567999
Occupation	2.0671	0.5586
Visit frequency	8.9274	0.0629
Menu familiarity	7.2466	0.0644

Table 2: Pre-Experiment Randomization Check

III. Results Analysis

We performed three main analyses with the data collected: average treatment effect (ATE), Cohen's d and regressions.

Choice Consistency

❖ ATE

The results of our Average Treatment Effect (ATE) analysis indicate that menu complexity has a significant impact on consumer choice consistency. Specifically, participants in the Limited Menu group exhibited a 24.18% higher likelihood of selecting their default beverage compared to those in the Extensive Menu group (ATE = 0.2418). This finding suggests that when faced with a simplified menu, consumers are more likely to rely on habitual decision-making and choose familiar options rather than exploring new alternatives. In contrast, when presented with a larger set of choices, consumers may experience greater decision uncertainty, leading to deviations from their default selections.

Furthermore, the statistical significance of this effect ($p = 0.0117$, $p < 0.05$) confirms that the observed difference is unlikely to be due to random variation. Our results suggest that optimizing menu design by reducing excessive choice complexity may help enhance consumer decision confidence and streamline the selection process, particularly for individuals who prefer habitual choices.

Estimate of ATE	0.2418
t-score (t)	2.5650

p-value (p)	0.0117

Table 3: Summary of ATE estimation (Choice Consistency)

❖ Regression Analysis

Building on our ATE analysis, we conducted a regression analysis to further examine how menu complexity influences consumers' choice consistency. The regression results show that the coefficient for treat is 0.2418 ($p = 0.012$, $p < 0.05$), meaning that participants in the Limited Menu group were 24.18% more likely to choose their default beverage compared to those in the Extensive Menu group. This result indicates that a simple menu structure reinforces habitual choices, making consumers more likely to stick with familiar options rather than explore new ones.

OLS Regression Results

Dep. Variable:	choice_consistency	R-squared:	0.058
Model:	OLS	Adj. R-squared:	0.050
Method:	Least Squares	F-statistic:	6.573
Date:	Thu, 06 Mar 2025	Prob (F-statistic):	0.0118
Time:	19:10:02	Log-Likelihood:	-75.118
No. Observations:	108	AIC:	154.2
Df Residuals:	106	BIC:	159.6
Df Model:	1		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	0.3654	0.068	5.381	0.000	0.231	0.500
treat	0.2418	0.094	2.564	0.012	0.055	0.429

Omnibus:	1238.048	Durbin-Watson:	1.715
Prob(Omnibus):	0.000	Jarque-Bera (JB):	13.816
Skew:	0.031	Prob(JB):	0.00100
Kurtosis:	1.249	Cond. No.	2.66

Table 4: Regression Results (Choice Consistency)

To investigate the relationship between menu complexity and consumer decision-making further, we analyze changed preference, which measures whether participants selected a beverage different from their default choice. The coefficient for treat is -0.2418 ($p = 0.012$, $p < 0.05$), indicating that participants in the Limited Menu group were 24.18% less likely to switch from their default choice compared to those in the Extensive Menu group. Additionally, the constant term (coef = 0.6346) represents the predicted probability that participants in the Extensive Menu group would change their preference. In other words, with a larger menu, 63.46% of participants chose a different beverage instead of their usual one.These findings show that menu complexity significantly affects how consumers make decisions. A larger menu encourages consumers to try different options, while a smaller menu makes them stick to their usual choices.

```
                            OLS Regression Results
==============================================================================
Dep. Variable:     changed_preference   R-squared:                       0.058
Model:                            OLS   Adj. R-squared:                  0.050
Method:                 Least Squares   F-statistic:                     6.573
Date:                Thu, 06 Mar 2025   Prob (F-statistic):             0.0118
Time:                        19:26:58   Log-Likelihood:                -75.118
No. Observations:                 108   AIC:                             154.2
Df Residuals:                     106   BIC:                             159.6
Df Model:                           1
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const          0.6346      0.068      9.346      0.000       0.500       0.769
treat         -0.2418      0.094     -2.564      0.012      -0.429      -0.055
==============================================================================
Omnibus:                     1238.048   Durbin-Watson:                   1.715
Prob(Omnibus):                  0.000   Jarque-Bera (JB):               13.816
Skew:                          -0.031   Prob(JB):                      0.00100
Kurtosis:                       1.249   Cond. No.                         2.66
==============================================================================
```

Table 5: Regression Results (Changed Preference)

Decision Time

To further explore how menu complexity affects consumer decision-making, we will analyze the relationship between Decision Time and Treat (menu complexity condition). Previous findings suggest that menu complexity impacts choice consistency and preference shifts, indicating that decision-making patterns may differ across menu conditions. By examining Decision Time, we aim to determine whether a Limited Menu results in quicker or more deliberate choices compared to an Extensive Menu.

❖ ATE

The results indicate that menu complexity has a statistically significant impact on decision time. The ATE of 21.38 seconds suggests that participants in the Limited Menu group took, on average, 21.38 seconds longer to make a decision compared to those in the Extensive Menu group. The t-score of 2.6478 and p-value of 0.0094 ($p < 0.05$) confirm that this difference is statistically significant, meaning it is unlikely to have occurred by chance. We hypothesized that reducing menu complexity would not necessarily lead to faster decision-making. Instead, it might create uncertainty, causing participants to spend more time evaluating their options.

Estimate of ATE	21.3770
t-score (t)	2.6478

p-value (p)	0.0094

Table 6: Summary of ATE estimation (Decision Time)

❖ Cohen's d

To test our hypothesis, we calculated Cohen's d value. The result showed that the Cohen's d value is equal to 0.5050 which means that there's a moderate effect size of menu complexity on decision time. This suggests that the difference in decision time between the Limited Menu group and the Extensive Menu group is not only statistically significant but also practically meaningful.

Cohen's d	0.5050

Table 7: Result of Cohen's d (Decision Time)

❖ Confidence Interval

We also calculated confidence intervals. The results provide strong evidence that reducing menu options does not speed up decision-making but instead increases it by at least 5.55 seconds and possibly up to 37.20 seconds.

95% CI for ATE (Decision Time)	(5.5529, 37.2012)

❖ Regression Analysis

We performed a regression model and the results confirm that menu complexity has a statistically significant impact on decision time. The coefficient for treat (21.38, $p = 0.010$) indicates that participants in the Limited Menu group took 21.38 seconds longer on average to make a decision compared to those in the Extensive Menu group. The p-value of 0.010 ($p < 0.05$) also confirms that this effect is statistically significant.

Additionally, the constant term (41.35) represents the average decision time for the Extensive Menu group, indicating that participants in this condition took approximately 41.35 seconds to make a selection. The R-squared value (0.061) suggests that menu complexity explains about 6.1% of the variance in decision time, which means other factors may also contribute to

decision-making duration.

OLS Regression Results

Dep. Variable:	decision_time_numeric	R-squared:	0.061
Model:	OLS	Adj. R-squared:	0.052
Method:	Least Squares	F-statistic:	6.875
Date:	Thu, 06 Mar 2025	Prob (F-statistic):	0.0100
Time:	21:57:05	Log-Likelihood:	-556.76
No. Observations:	108	AIC:	1118.
Df Residuals:	106	BIC:	1123.
Df Model:	1		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	41.3462	5.871	7.043	0.000	29.707	52.985
treat	21.3771	8.153	2.622	0.010	5.213	37.541

Omnibus:	13.614	Durbin-Watson:	2.202
Prob(Omnibus):	0.001	Jarque-Bera (JB):	15.895
Skew:	0.938	Prob(JB):	0.000354
Kurtosis:	2.900	Cond. No.	2.66

Table 8: Regression Results (Decision Time)

IV. Limitation:

While our study provides valuable insights into the impact of menu complexity on consumer decision-making, several limitations should be acknowledged:

- **Limited Generalizability:** The experiment was conducted within the context of Starbucks beverages, which may not fully represent decision-making behaviors in other product categories or retail settings. And the majority of our participants were Gen Y & Z students, which may limit the applicability of our findings to broader consumer groups.
- **Binary Treatment Design:** The experiment categorized participants into two distinct menu conditions (Limited vs. Extensive Menu). However, real-world menus exist on a spectrum, and different levels of menu complexity may have varying effects on decision behavior.
- **Decision Time Categories:** Decision time was measured using predefined time intervals rather than exact timestamps. This may introduce some level of measurement error or recall bias.

V. Conclusion

Our study investigates how menu complexity affects consumer decision-making. The results show that a Limited Menu increases the consistency of consumer choices, making consumers more likely to select their usual or default beverage. In contrast, an extensive menu encourages consumers to explore different options, leading to more frequent changes in preference. These findings align with the choice overload theory, which suggests that having too many options can overwhelm consumers and influence their selection behavior.

Additionally, our analysis of decision time found that participants using a limited menu took an average of 21.38 seconds longer to make a decision, with a moderate effect size (Cohen's $d = 0.5050$). This result challenges the assumption that simpler menus always speed up on decision-making. Instead, it suggests that fewer options might cause consumers to spend more time carefully evaluating their choices.

Appendix:

Notebook:

https://colab.research.google.com/drive/1ajX828okgMqmvNWDIbrQGBkM8jD8FYBl?usp=sharing

Survey Design

What is your age range? *

- Under 18
- 18-29
- 30-49
- 50+

What is your current occupation status? *

- Student
- Employed
- Both Employed and Studying
- Unemployed/Retired

Which of the following categories best describes your default choice when ordering at Starbucks?

- Choose a Coffee-based beverage (e.g., Latte, Americano, Espresso)
- Choose a Tea-based beverage (e.g., Matcha Latte, Chai Latte, Iced Tea)
- Choose a Frappuccino®
- Choose a Refresher beverage
- None

Limited Menu

If this is the Starbucks menu, which beverage would you like to try? *

- Latte

- Americano

- Matcha Latte

- Chai Latte

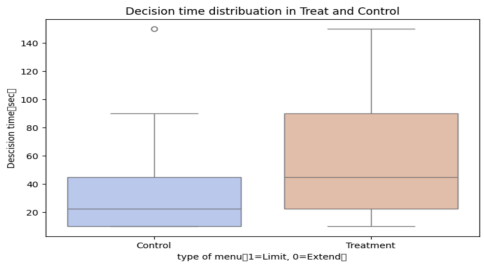
- Caramel Ribbon Crunch Frappuccino®

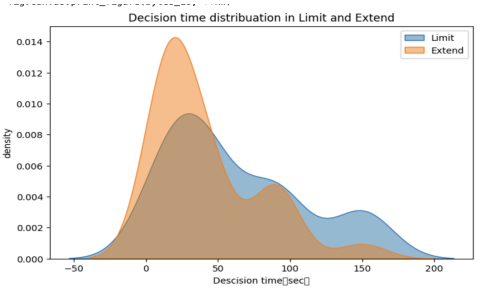
- Matcha Crème Frappuccino®

- Strawberry Açaí Refresher

- Mango Dragonfruit Refresher

Decision time Plot





Extensive Menu

If this is the Starbucks menu, which beverage would you like to try? *

- Latte (Hot)

- Matcha Latte (Hot)

- Java Chip Frappuccino®

- Strawberry Açaí Refresher

- Iced Latte

- Iced Matcha Latte

- Chocolate Crème Frappuccino®

- Mango Dragonfruit Refresher

- Americano (Hot)

- Chai Latte

- Caramel Ribbon Crunch Frappuccino®

- Cran-Merry Orange Refresher

- Iced Americano

- Iced Chai Latte

- White Chocolate Mocha Frappuccino®

- Blackberry Sage Refresher

- Cappuccino

- Iced Green Tea

- Matcha Crème Frappuccino®

- Pink Drink®

- Iced Cappuccino

- Iced Peach Green Tea

- Vanilla Bean Crème Frappuccino®

- Dragon Drink®

- Espresso (Hot)

- Iced Black Tea

- Espresso Frappuccino®

- Cran-Merry Drink®

- Iced Espresso

- Iced Passion Tango® Tea

- Chestnut Praline Frappuccino®

- Midnight Drink®